Patent claims

1. A flame-resistant aminoplast resin system, in particular melamine-formaldehyde resin, melamine/urea-formaldehyde resin or urea-formaldehyde resin system, comprising

a) a modified aminoplast resin matrix, the primary aminoplast condensates being present at least partly in etherified form in the modified aminoplast resin, and the modified aminoplast resin having been obtained from a substantially solvent-free aminoplast resin melt, and

b) at least one compound which contains phosphorus and/or nitrogen and/or boron in chemically bonded form and is present in encapsulated form, in particular in a form enclosed by a capsule wall material, in the aminoplast resin matrix, as a flame-retardant component.

2. The aminoplast resin system as claimed in claim 1, characterized in that the aminoplast resin is etherified with C_1-C_4-alcohols.

3. The aminoplast resin system as claimed in either of claims 1 and 2, characterized in that the modified aminoplast resin contains transetherification agents and/or modifiers and/or fillers, reinforcing fibers, further polymers, stabilizers, UV absorbers and/or auxiliaries.

4. The aminoplast resin system as claimed in claim 3, characterized in that the transetherification agents used are aliphatic C_4-C_{18}-alcohols or aromatic alcohols, diols, polyols or mixtures thereof.

5. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that at least one compound present in encapsulated form contains ammonium polyphosphate, melamine polyphosphate, phosphoric acid ester and phosphonic acid ester based on the reaction of phosphorus pentoxide or phosphorus trioxide with pentaerythritol or dipentaerythritol, and ammonium and melamine salts thereof.

6. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that at least one compound present in encapsulated form also has a proton-liberating effect in addition to the flame-retardant effect.

7. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that it contains a plurality of different compounds present in encapsulated form.

8. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the capsule wall material comprises a thermosetting resin, in particular an aminoplast resin, an epoxy resin, an unsaturated polyester resin or a phenol resin.

9. The aminoplast resin system as claimed in claim 8, characterized in that the capsule wall material comprises a modified aminoplast resin which has surface properties similar to the modified

aminoplast resin forming the modified aminoplast resin matrix.

10. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that at least one compound present in encapsulated form is present in homogeneously distributed form in the aminoplast resin matrix.

11. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the ratio of diameter to capsule wall thickness of the capsules is from 5 to 1000.

12. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the average diameter D of the capsules is in the range of 1-100 µm, preferably of 10-60 µm, particularly preferably of 20-50 µm.

13. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the geometrical shape of the capsules is spherical.

14. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the amount of at least one compound present in encapsulated form is from 0.5 to 50% by weight, preferably from 1 to 40% by weight, particularly preferably from 5 to 25% by weight, based on the total weight of the cured aminoplast resin system.

15. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that the amount of at least one compound present

in the capsules is from 50 to 98% by weight, preferably from 70 to 90% by weight, based on the total weight of a compound present in encapsulated form.

16. The aminoplast resin system as claimed in at least one of the abovementioned claims, characterized in that at least one compound present in encapsulated form is added to the modified aminoplast resin as powder and/or as suspension.

17. The aminoplast resin system as claimed in claim 16, characterized in that the substantially solvent-free aminoplast resin melt and/or at least a part of the transetherification agents and/or modifiers used for modifying the aminoplast resin are used as suspending agents.

18. The aminoplast resin system as claimed in claim 16, characterized in that the solids content of the suspension is from 30 to 90% by weight, preferably from 40 to 80% by weight, and the viscosity is from 10 to 5000 mPa.s, preferably from 250 to 1000 mPa.s.

19. A process for the preparation of a flame-resistant aminoplast resin system, characterized in that

a) a modified aminoplast resin solution or aminoplast resin suspension is prepared from an aminoplast former, a carbonyl compound and a C_1-C_4-alcohol at pH = 2 to 7, a temperature of from 40 to 160°C and a pressure of from 0 to 5 bar and a reaction time of from 5 to 300 minutes,

b) after the pH has been made alkaline, the modified aminoplast resin solution or aminoplast resin suspension is concentrated by distilling off the solvent at from 50 to 180°C and from -1 to 0 bar and in a residence time of from 1 to 120 minutes to give a substantially solvent-free aminoplast resin melt,

c) the substantially solvent-free aminoplast resin melt is reacted at a temperature of from 130 to 250°C and from -1 to 0 bar and in a residence time of from 0.5 to 10 minutes in an extruder or kneader for pre-condensation and conditioning,
the addition of at least one compound enclosed by a capsule wall material, i.e. present in encapsulated form, being effected during or after step a) and/or during or after step b) and/or during or after step c), whereupon

d) the flame-resistant aminoplast resin system is compounded and discharged.

20. The process as claimed in claim 19, characterized in that transetherification agents and/or modifiers are added to the modified aminoplast resin during or after step a) and/or during step b) and/or during step c).

21. The process as claimed in claim 20, characterized in that the addition of at least one compound present in encapsulated form in the form of a suspension in the transetherification agents and/or modifiers is effected during the reactive conversion in an extruder.

22. The process as claimed in any of claims 19 to 21, characterized in that the reactive conversion is carried out in two extruders connected in series.

23. The use of a flame-resistant aminoplast resin system for the preparation of hybrid resin systems, the hybrid resin systems being prepared by mixing and/or chemical reaction of the flame-resistant aminoplast resin systems with modified and/or unmodified melamine-formaldehyde resins, epoxy resins, polyurethane resins, unsaturated polyester resins and/or alkyd resins as melts in a kneader, mixer or extruder.

24. The use of a flame-resistant aminoplast resin system in the form of granules and/or powder as compression molding resin or as injection molding resin.

25. The use of a flame-resistant aminoplast resin system for the production of a composite material, a substrate material being coated with the flame-resistant aminoplast resin system in powder form and/or the aminoplast resin system being melted and the substrate material being drawn through the resin melt, whereupon a pre-condensation step in the range of about 110-250°C for a duration of about 1-10 minutes is effected, whereupon the storable prepreg obtained is subjected to shaping with a temperature increase and is cured thereby.

26. The use of a flame-resistant aminoplast resin system for pipes, sheets, profiles, injection molded parts or fibers, as a curing agent or crosslinking agent in powder coating systems or for the production of flame-resistant shaped articles.

27. A composite material, produced in that a substrate material is coated with a flame-resistant aminoplast resin system as claimed in any of claims 1 to 18 in powder form and/or the aminoplast resin system is melted and the substrate material is drawn through the resin melt, whereupon a pre-condensation step in the range of about 110-250°C for a duration of about 1-10 minutes is effected, whereupon the storable prepreg obtained is subjected to shaping with a temperature increase and is cured thereby.

28. The composite material as claimed in claim 27, produced in that the shaping and curing are effected by a pressing process in an acidic pH range of pH 3-pH 6.5 at from 90 to 250°C and from 10 to 250 bar compression pressure and for a duration of from 0.5 to 30 minutes.